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OPTICO-CILIARY NEUROTOMY,  
THE PROPOSED SUBSTITUTE FOR EXTIRPATION OF A  
LOST AND PAINFUL EYE BALL.

BY

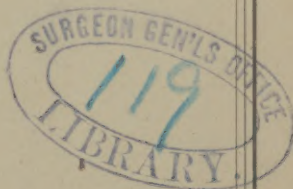
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EYE AND EAR CHARITY HOSPITAL OF BALTIMORE.

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## OPTICO-CILIARY NEUROTOMY, THE PROPOSED SUBSTITUTE FOR EXTIRPATION OF A LOST AND PAINFUL EYE BALL.

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The very recent application of nerve section for the relief of painful and dangerous eye affections, a substitute for the enucleation of the eyeball, is rapidly growing in favor, as evidenced by the published reports of consecutive trials at the hands of many surgeons. During the past three months, domestic and foreign journals have freely discussed the advantages of the new departure in eye surgery, and have sounded its praises in no doubtful manner. It is only two years since Dr. Schœler in Germany and Dr. Abadie in France, have attempted to popularize the operation of Optico-Ciliary Neurotomy for the relief of pain and the prevention of sympathetic ophthalmia; notwithstanding which the advantages of the nerve section have spread very slowly. Within the past few months, however, many surgeons can be found who have given a trial to this clever method of saving lost but good looking eyes, and retaining them isolated from all harm by destroying the close nervous sympathies with the twin organ.

The following summary has been collated from notices in recent European medical journals, and especially from the writings of M. Warlomont, M. Girard Teulon, M. Paul Redard and others :



In studying the history of enervation of the eye, we find the first reported suggestion of nerve section, as a good substitute for extirpation of an eyeball, coming from that fertile source of so many good things in ophthalmic surgery, Von Græffe, of Berlin. As far back as 1866, he suggested the division of the offending nerve, both within the eyeball and also in the socket, to relieve ciliary pain and for the isolation of a dangerous eye. Singular to say, he left no written evidence that he had put into practice the valuable hints which he had thrown out. In the same year, Rondeau, of Paris, in a thesis published in 1866, makes the identical suggestion and refers to the ease with which the optic nerve and the ciliary nerve accompanying it can be divided as they enter the back of the eyeball. He says that nothing is easier than this operation of optico-ciliary neurotomy which "I have practiced more than once in the amphitheatre," meaning on the dead subject. He refers to its necessary effect in preventing reflex action in the opposite organ. He explains the method of procedure, how with a curved tenotomy knife introduced through a conjunctival incision at the inner canthus, the optic nerve, ciliary nerve, and ophthalmic artery can all be divided simultaneously. Yet again, we have no evidence that Rondeau advanced from the cadaver in his operative manual. E Meyer in 1866, Landsberg in 1869 and Snellen in 1873 seem each to have performed an operation of this nature, but they did not follow up their individual cases by successive repetitions.

In 1876, 10 years from the time when this neurotomy was first put forward by Von Græffe in Germany and M. Rondeau in France, M. Boucheron, in an article published in the *Gazette Medical of Paris*, forces the operation of optico ciliary neurotomy to the attentions of surgeons. He performed this posterior ocular section on living animals to show that nerve sections do not necessarily cause atrophy or disorganization to the enervated eye-ball, and that the operation may be safely carried out on the human subject. To this surgeon is accredited the first neurotomy on the living subject, although Schœler of Berlin lays claim to priority in publications for 1877 and 1878. This German Surgeon seems to have appreciated more fully the value

of the suggestions which had been sleeping on the Continent of Europe 12 years, and in an active way, through published articles forced them upon the attention of German Surgeons. From October 1877, when his first neurotomy upon the back of the eye-ball was performed, other cases were soon made to follow in the wake of the pioneer. While in these publications he gives Boucheron credit for earlier announcements he states "that up to this time Boucheron's proposition had not been noticed in German journals and he was not aware that the operation had ever been successfully carried out upon the human living subject." The favorable endorsement of Boucheron's proposition by Schœler, and the report of a number of successful cases by this skillful surgeon with a similar number reported in France in the Clinic of M. Dianoux and M. Abadie of Nantes caused the neurotomy treatment to be practiced as a regular and highly proper surgical procedure. Now this new operation has been formally accepted by the leading ophthalmologist in both Hemispheres. Surgeons in all the large cities are hastening to test the advantages of Optic-Ciliary Neurotomy as a good substitute for extirpation of the eye-ball in cases in which sympathetic inflammation of the remaining good eye is to be feared.

Although persons operated upon by this method can already be numbered by the hundreds, unfortunately, time is necessary to prove the permanent value of this new departure which promises so much, and which surgeons and patients are so willing to accept. No one can question the safety and the permanent protection which belongs to enucleation. That the removal of a lost and painful eye ball will at once put a stop to threatened trouble in the good one, thousand of grateful patients attest. There is no operation in the entire domain of surgery more thoroughly established and more highly prized than the one of releasing by the extirpation of a lost and painful eye, the good eye from the thralldom in which it is held, through sympathetic nervous bands which tie the eyes so intimately together for good or for evil.

In contrasting the operation of optico-ciliary neurotomy and of eye ball enucleation, the inference is clearly drawn in favor of cutting the nerves only, leaving the enervated ball still a mass



of living tissue to be moved about by its muscles, although dead to any reflex trouble which its presence would otherwise occasion. Hence the preferable acceptance of a neurotomy instead of an extirpation. This new operation has good grounds for favorable comparison; many surgeons believing that it offers the same degree of protection as is known to follow the removal of the injured eye. It avoids mutilation and the mental horrors which accompany such a proposition as the taking out of an eye. This is a very important consideration in the minds of the unfortunates who have this only alternative offered them against prospective permanent blindness. At the same time, the operative procedure of neurotomy is simple in its design and easy of execution, needing less time to perfect it than is required to remove an offending eye ball.

The operative treatment as practiced by various surgeons, presents four or five different methods for performing this neurotomy. They are, however, all capable of being condensed into two classes. In both an opening is needed through the conjunctiva by which the back of the eye ball can be reached and the entering nerves exposed for division. Some surgeons consider a horizontal conjunctival wound as all sufficient for perfecting the steps of the neurotomy, while others practice the detaching of the tendon of a rectus muscle by means of a vertical incision through conjunctiva and tendon so as to give more room for the manipulation of instruments. M. Rondeau, in his paper on reflex ocular affections and sympathetic ophthalmia, published in 1866, speaks of a simple method which he had practiced in the amphitheatre on the cadaver. He describes his operation by commencing an incision in the conjunctiva at the inner canthus and above the upper edge of the internal rectus muscle. A small opening, he says, large enough however to permit the introduction of a small curved tenotomy knife, which could be readily pressed behind the eye ball, and by a sawing movement imparted to it, is made to divide all the structures, whether they be nerve or blood vessels, found within the cone of muscles as they pass from the back of the socket to the globe. The destruction of the central retinal artery and

ciliary branches of the ophthalmic, does not rob the eye ball of its entire vascular supply. Many vessels perforate the anterior portion of the sclerotic, climbing from behind forward upon the bodies of the recti muscles. From these well-known sources of blood supply nutrition goes on so satisfactorily that trophic changes are not likely to occur in the enervated eye ball. When one or even two muscles are divided vertically and their respective vessels severed, the remaining vessels of the undivided muscles not implicate in the operation, are believed to be quite sufficient to ensure a vascular supply to the organ.

Boucheron, in his paper published in 1876, expresses preference for a conjunctival opening at the *external canthus* between the superior and external recti tendons, through which opening, he says, the capsular space can be easily reached. A curved scissors introduced through this opening with blades separated when the blunt ends of the instrument reaches the posterior surface of the eye ball, will include the optic nerve and ciliary fibres. Their section can be thus ensured, especially if the anterior portion of the sclerotic exposed by the wound in the conjunctiva, be seized by a fixation forceps, and the eye ball be rotated forcibly inward. When the section of the optic nerve and its surroundings has been made, he recommends that the forceps be introduced into the depth of the wound and the sclerotic seized at its posterior pole. In this way the eye ball may be rotated so excessively as to bring the posterior hemisphere into view. This manœuvre exposes every remaining nerve fibre, which had previously escaped the scissors, to be now divided under visual inspection.

M. Dianoux in 1877, advised section of the nerves through a conjunctival opening made at the *inner canthus*, between the internal and the inferior recti tendons. Into the free horizontal incision he introduces the little finger and when the optic nerve is felt by the end of it, he uses the finger as a guide for the curved scissors. In this manner it is surely carried down to the structure which he desired to sever. The scissors being then withdrawn the free play of a strabismus hook over the posterior pole of the eye ball was to him a guarantee that all the nerves which entered the back of the eye had been divided. By these various



modifications the back of the eye ball can be reached through a horizontal conjunctival incision, whether made in the outer or inner, upper or lower quadrant of the inter-palpebral surface. These methods differed in no great respect from each other, and secure the desired exposure with the least possible destruction of the appertenances of the visual organ.

Meyer, who described his method of operation at the Ophthalmological Congress held at Paris in 1868, practiced first tenotomy of the external rectus, and then passed a thread through the cut end of the muscle. By means of the thread he could draw the muscle out, at the same time seizing the sclerotic near the cornea with a tooth forceps, could rotate the ball forcibly inwards. Through this gaping wound the sub conjunctival tissue could be readily dissected from the eye ball. The tendons of the two oblique muscles would then be severed before the optic nerve and the ciliary fibres were divided. The free division of these muscles allows the posterior pole of the eye ball to be brought forward, and insures the destruction of all the nerve fibres, which alone can prevent reflex sympathetic annoyance in the good eye. To make this rotation complete, Meyer recommended also the section of the internal rectus muscle. With both the inner and outer rectus severed, and the tendons of the two oblique muscles cut from their sclerotic attachment, the division of the optic nerve would allow the posterior pole of the eye to be rotated forward temporarily, to the place usually occupied by the cornea, and then every nerve fibre could be carefully dissected away from the posterior hemisphere.

Schoeler, in 1877, adopted the method suggested by Meyer without so extensive a separation of muscular attachment. He made a vertical opening through the conjunctiva at the external border of the cornea, and having divided the external rectus tendon extended the extremities of the incision until they reached the outer edge of the upper and lower recti. By drawing apart the lips of this wound, there was ample room to introduce the heavy blunt enucleation scissors and to manipulate them so as to divide all the posterior tissue. He then introduced a curved knife and moved it about freely behind the globe so as to



ensure the severance of such nerve fibres as may have escaped the blades of the scissors.

M Abadie, in 1878, adopted a similar method. All of those who preferred a tenotomy to secure a sufficiently large opening to permit rotation and ensure the severance of the nerves as it were under vision, sutured the muscle back in position to the eye ball so as to avoid traumatic squint.\* In like manner Schweigger, of Berlin, in 1877, adopted the vertical section with tenotomy, but locates the opening at the inner canthus, taking the precaution of cutting conjunctiva and tendon together, and not make any distinction between these structures. By inserting a fine hook into the sclerotic near the posterior pole, he could easily control the eye ball and induce forcible rotation inwards and forwards to ensure a thorough nerve section.

There is no doubt that the nerves can be exposed by any of these methods. In all of my earlier neurotomies I adopted a modification similar to that now known as Schweigger's; but lately I have preferred the single horizontal conjunctival incision, *the primitive operation*, and find among the latest reported cases a decided tendency to go back to this simple operation as recommended by French authorities and known as the methods of Rondeau or Boucheron. In my ten optico-ciliary neurotomies I have always located the incision at the inner canthus, preferring this to the outer section. In my last operations I found no trouble in manipulating the heavy enucleation curved scissors through a horizontal conjunctival incision extending parallel with the upper edge of the tendon of the internal rectus muscle from the corneal border to the caruncula. If Knapp's suggestion be carried out of using strabismus hooks as retractors for gaping excessively the wound, and aid rotation by implanting a fine double hook into the sclerotic at the posterior pole of the eye ball, there can be no difficulty in ensuring a perfect division of all posterior ocular nerves.

The operation is very much simplified by avoiding the tenotomy. The most tedious portion of the operative procedure is in reattaching by nice adjustment the divided tendon to its proper position on the sclerotic. If the method by muscle detach-

ment be preferred the conjunctiva, fascia, and tendon should be divided as one substance; there will then be but little muscular retraction. In replacing the tendon I used a stout silk thread with fine curved needle at each end of it. The body of the muscle with conjunctiva can be tranfixed through the opening of the wound by each needle, and needle points made to protrude on either side of the caruncular. If the thread be now drawn upon so as to have the center of the thread as a loop against the inner face of the muscle deeply embedded in the wound, the future movements of the muscle will be under perfect control. Each needle is then entered anew at the respective upper and lower angles of the vertical incision and made to glide under the conjunctiva and come out over the tendon of the upper and lower rectus muscles, respectively. In drawing upon the ends of the thread and tying them together as a suture, the divided muscle is drawn well forward and the eye-ball resumes its normal position. When this muscle is in this way secured I found that it reunited speedily to the eye-ball and left afterwards no perceptible squint. The threads were removed one week after their application. In my first case for want of proper adjustment there was a slight outward deviation of the eye-ball, but in all later cases as I drew the threads more firmly, even to forcing the eye-ball toward the caruncula the adjustment was perfect, and no squint could be detected one month after the neurotomy had been performed. If the thread be passed deeply through the belly of the muscle and be well tied across the edge of the cornea I found that no displacement of the tendon could take place, regardless of the degree of protrusion which the extravasated blood behind the eye-ball may occasion.

By restricting the wound to a horizontal incision of conjunctiva alone, leaving the recti tendons in tact, the operation of optico-ciliary neurotomy is robbed of all its dangers, especially as to eye displacement, and also as regards tendon manipulation. In my last case of enervation of an eye ball for perforated wound and traumatic destruction of sight with already commencing sympathetic irritation in the good eye, I do not think that more than ten minutes were spent in the entire operation including the

chloroforming and the completion of the nerve section, although the posterior face of the eye-ball was rotated forward by a hook and exposed in the well stretched wound so as to ensure the division of all posterior structures.

From my experience derived from ten neurotomies, I fail to appreciate many of the dangers referred to by other operators. In every case I used chloroform as the pain preventing agent, as the operation would of necessity be very painful without the intervention of an anæsthetic, and chloroform has always served me best for general anæsthesia.

Free hemorrhage has been referred to as one of the dangerous complications of this new operation. I can hardly imagine an amount of hemorrhage sufficient to do harm in this section for preserving a lost eye. The cut ciliary arteries and optic nerve vessels will discharge a certain amount of blood which wells up rather freely for a few moments through the gaping wound. In my cases the amount lost never exceeded a few drachms at most. When the tendon is stretched in its normal position, and the wound closed, a small quantity of blood will continue to escape from the divided vessels, if iced water applications, with a firmly secured compress be not used. Pent up as it is behind the eye ball, this effused blood must cause some degree of protrusion of the organ. It will also force itself into the connective tissue of the socket and lids, the latter becoming more or less discolored from blood infiltration. If the extravasation of blood be great the only trouble likely to occur from it is the straining of the newly sutured tendon, and in this way disturb the desirable relations which we would like to retain between the tendon and the sclerotic surface of the eye ball. The worse result that this stretching can bring about is to leave some degree of squint, to be corrected if desired by some subsequent operation. If the tenotomy is not practiced this accident cannot occur.

Ordinarily the danger of post ocular collection, especially when suddenly formed, is from injurious traction on the optic nerve, as the eye ball is forced forward. In these cases of lost eyes with a severed nerve this cannot become an item for consideration. I have hailed the orbital extravasation as the



harbinger of good, in as much as it ensures a more or less extensive separation of the cut ends of the nerves and lessens the likelihood of any reunion taking place in them. This blood which bends the nerve ends out of their straight course and fixes them out of line must be in time absorbed. It has been suggested that the organization of the blood clot, and the development of connective tissue in it, might act injuriously in aiding the reunion of the nerve ends. The probability of this occurring is extremely remote, although one case of such organization has been reported.

Of acute inflammatory processes in the enervated eye ball or in the socket tissue I have experienced none, notwithstanding, I have in no case applied the precaution laid down as so essential by M. Abadie, of using compression bandages for 48 hours with a very low temperature, and of keeping the eye and face constantly under the influence of antiseptic carbolyzed dressings. M. Redard, however, in his essay on optico-ciliary neurotomy published in 1879, refers to cases of corneal sloughing and also of cellulitis of the orbital tissues. In the category of bad consequences, I would not mention the evacuation of the eye ball through accidental incision in the sclerotic near the posterior axis. Such accident should not happen to patients in the hands of even ordinarily careful surgeons.

I have enumerated all of the immediate accidents which have been met with. There are some more remote which may necessitate either a repetition of the operation or the removal of the eye ball: as when pain returns in the lost eye, an evidence either that the nerves had not all been divided, or that a re-union in the cut ends has been reestablished. This sequel has actually happened to all who have had much experience with this new operation. In such cases enucleation has had to follow the neurotomy in the course of a few weeks or months, the substitute having failed to give the permanent relief expected. In my own 10 cases I have been compelled already to remove two eye balls—one three weeks after section, and the other after an interval of five months. In both cases there had been a complete and instantaneous relief from pain, with anæsthesia of the cornea in evidence that the nerve section had been complete. Both patients had been

suffering fearfully before the operation. In these cases I had given the patients a chance of retaining a better looking, although enervated eye, than could be supplied by any artificial glass substitute. When their cases turned out failures I had only to revert to the first consideration and enucleate the again offending organ. The other eight have had no trouble. To them the new operation has been a very great comfort, saving them much expense in the purchase of artificial eyes and endless trouble in their daily application. If only one of five cases should require secondary enucleation instead of the removal of the eye from the five, the advantage to the four are quite sufficient to warrant the attempt of retaining the eye ball in the fifth.

The advantages of neurotomy are so prominent that no surgeon can now hesitate to accept it as a decided advance in ophthalmic surgery. It will be the means of protecting a very large number of persons who, when an eye has been destroyed by an accident, will not hear of its removal and yet would gladly accept a neurotomy to stop pain and to protect the good eye from the danger of sympathetic inflammation. It is the mutilation, of having an eye taken out and the horrors conceived by timid patients of such an operation, that deters so many from accepting the enucleation to their serious detriment and future life-long regrets. When you can promise a patient suffering from a most painful cyclitis in a lost eye, that you can promptly put an end to his fearful suffering, and at the same time not take his eye out, no one can be found who will not gladly accept the treatment, even when the terrifying name of operation is attached to it.

The advantages of neurotomy over enucleation has but one detraction, viz: that it does not in every case succeed. When applied to lost and painful eyes, whether from injury, choroido-iritis, or when glaucoma has completely run through its stages from injury, it does not offer that absolute protection which we would desire for it. Also that for certain intra-ocular diseases as newgrowths, etc., extirpation of the offending organ must always hold its ground. For tolerably good looking although useless eyes, which are the seat

of pain and threaten reflex troubles, the new operation must ever take precedence. Attacks of pain so often occurring in extensively diseased eyes can be promptly cut short and in most cases be permanently prevented by the nerve section; and this can be effected in a very few minutes under the painless influence of an anæsthetic. Even in cases of atrophic eye-balls, the severance of the nerves with the anæsthetic cornea therefrom induced, will make a good stump for the nice adjustment of an artificial eye, which otherwise on account of corneal irritation from mechanical friction could not be worn. Hereafter lost and painful eyes will be much more sparingly condemned to extirpation. The enervation of the eye ball will be more extensively used as a means of preventing recurrent attacks of pain in eyes lost from any cause, and even where the sympathetic extension of inflammation to the good eye is not looked for.

The after treatment of such cases is exceedingly simple. Where no muscle is divided the after consequences are not much more serious than from a squint operation. Cold compresses are applied to the eye as soon as the operation is completed and the patient is kept in bed for at least one day, until the effects of the anæsthetic have altogether passed off. On the day after the operation the lids are found slightly swollen and stiffly drawn over the protruding ball. The conjunctiva is found much discolored with extravasated blood when the lids are drawn apart. Within forty-eight hours the swelling has perceptibly diminished, and in three or four days has altogether disappeared in the majority of my cases. Some discoloration of the lids will remain for a few days longer, but is not conspicuous enough to keep the patient in the house or prevent him from resuming his daily occupation.

The most prominent sign that the nerve section has been satisfactorily accomplished is the complete loss of sensation in the cornea, which now can be touched without the patient being aware of the presence of a foreign body. The pupil will also dilate if the iris be free from adhesions. In most cases inflammatory inroads has so closed the pupil or tied it down to the capsule of the lens that no change in its appearance can be seen after the nerve section. If the cornea regains its sensitiveness in



the course of time it may be considered an evidence that reunion of the severed nerves has taken place. This was the case in both of my patients in whom extirpation of the ball had to be finally performed, to put an end to suffering which had reappeared in the lost eye after an interval of perfect comfort had followed the section of the nerves. In some of my cases atrophy of the eye-ball has taken place after the nerve section.







